AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously Presented) A method of optimizing a cycle time of a liquid dispensing module including an air piston housing with an air cavity having an initial air volume used to actuate the liquid dispensing module, an air piston located in the air cavity, and a solenoid valve capable of controlling the flow of pressurized air to and from the air cavity and having an effective valve flow coefficient, the method comprising:

selecting the initial air volume of the air cavity and the effective valve flow coefficient of the solenoid valve such that a cycle time of the liquid dispensing module is less than or equal to 9 milliseconds.

2. (Original) The method of claim 1 wherein the cycle time is less than or equal to 5 milliseconds.

3. (Cancelled)

4. (Previously Presented) The method of claim 1 wherein the effective valve flow coefficient is between about 0.1 to about 1.4.

5-7. (Cancelled)

8. (Previously Presented) The method of claim 1 wherein the initial air volume is less than about 2170 mm^3.

9. (Previously Presented) The method of claim 1 wherein the initial air volume is less than about 1500 mm^3.

10. (Previously Presented) A liquid dispensing module for dispensing a liquid onto a substrate, comprising:

a dispenser body including a discharge outlet, said dispenser body capable of receiving a flow of the liquid and discharging the flow of the liquid from said discharge outlet, said dispenser body including a flow-control mechanism characterized by an open position in which the flow of the liquid is discharged from the discharge outlet and a closed position in which the flow of the liquid is blocked, said dispenser body further including a nozzle-receiving space flanked by a wedge-shaped recess and a threaded passageway;

a set screw threadingly received within said threaded passageway;

an actuator operatively coupled with said flow-control mechanism, said actuator capable of actuating said flow-control mechanism between the open and the closed positions to selectively dispense the liquid from said discharge outlet; and

a nozzle removably mounted within said nozzle-receiving space of the dispenser body in fluid communication with said discharge outlet, said nozzle having a wedge-shaped side

portion that is engaged with said wedge-shaped recess in said nozzle-receiving space when said set screw is advanced in said threaded passageway to apply a force against said nozzle.

11-12. (Cancelled)

13. (Previously Presented) A liquid dispensing module for dispensing a liquid onto a substrate, comprising:

a dispenser body including a liquid inlet, a discharge outlet, a liquid recirculation outlet, and a flow channel capable of directing a flow of the liquid from said liquid inlet to said discharge outlet and said recirculation outlet;

a first valve seat disposed in said flow channel between said recirculation outlet and said liquid inlet;

a second valve seat disposed in said flow channel between said discharge outlet and said liquid inlet;

a first valve stem segment including a first valve plug;

a second valve stem segment including a second valve plug, said second valve stem segment operatively coupled for movement with said first valve stem segment, said first and said second valve stem segments being movable between a first position in which said first valve plug contacts said first valve seat to stop the flow of the liquid from said liquid inlet to said recirculation outlet and said second valve plug is out of contact with said valve seat to permit the flow of the liquid from said liquid inlet to said discharge outlet and a second position in which said first valve plug is out of contact with said first valve seat to permit the flow of the liquid from said liquid inlet to said recirculation outlet and said second valve plug contacts said second

valve seat to halt the flow of the liquid from said liquid inlet to said discharge outlet; and

an actuator associated with said dispenser body, said actuator operatively coupled with one of said first and said second valve stem segments to selectively apply an actuation force for moving said first and said second valve stem segments to provide said first and said second positions for selectively dispensing the flow of the liquid from said discharge outlet.

14. (Previously Presented) The liquid dispensing module of claim 13 wherein said actuator is operatively coupled with said first valve stem segment.

15. (Previously Presented) The liquid dispensing module of claim 13 wherein said first valve plug is a spherical head and said first valve seat includes an annular sealing surface capable of making a sealing engagement with said spherical head.

16. (Previously Presented) The liquid dispensing module of claim 13 wherein said second valve plug includes a first frustoconical sealing surface and said second valve seat includes a second frustoconical sealing surface capable of making a sealing engagement with said first frustoconical sealing surface.

17. (Previously Presented) The liquid dispensing module of claim 13 further comprising:

a first biasing element for applying a first biasing force to said first valve stem segment that urges said first valve plug in a direction toward said first valve seat.

18. (Previously Presented) The liquid dispensing module of claim 17 further comprising:

a second biasing element for applying a second biasing force to said second valve stem segment that urges said second valve plug in a direction toward said second valve seat.

19. (Previously Presented) The liquid dispensing module of claim 18 wherein said second biasing force is greater than said first biasing force so that said first and said second valve stem segments are in said second position when said actuation force is not applied.

20. (Previously Presented) The liquid dispensing module of claim 18 wherein the sum of said first biasing force and said actuation force is larger than said second biasing force so that said first and said second valve stem segments are in said second position when said actuation force is applied.

21. (Previously Presented) A dispensing apparatus for dispensing a liquid, comprising:

a liquid distribution manifold capable of heating the liquid;

a dispenser body capable of receiving a flow of the liquid from said liquid distribution manifold, said dispenser body including a flow-control mechanism having an open condition in which the flow of the liquid is discharged from said dispenser body and a closed condition in which the flow of the liquid is blocked;

a pneumatic actuator including a solenoid valve, an air piston housing coupled pneumatically with said solenoid valve, an air cavity defined within said air piston housing, and an air piston positioned within said air cavity, said air piston being coupled with said flow-control mechanism for providing said open and said closed conditions in response to a flow of

pressurized air to said air cavity from said solenoid valve; and

a thermally insulating shield positioned between said air piston housing and said liquid distribution manifold, said thermally insulating shield capable of reducing heat transfer from said liquid distribution manifold to said air piston housing.

22. (Previously Presented) The dispensing apparatus of claim 21, wherein said air piston housing includes a first material characterized by a first thermal conductivity and said thermally insulating shield includes a second material characterized by a second thermal conductivity that is less than the first thermal conductivity.

23. (Previously Presented) The dispensing apparatus of claim 22, wherein said second material is a nonmetal.

24. (Previously Presented) The dispensing apparatus of claim 23, wherein said nonmetal is a material selected from the group consisting of ceramics, polymers and glass fibers.

25. (Previously Presented) The dispensing apparatus of claim 21, wherein said thermally insulating shield is an imperforate member.

26. (Cancelled)

27. (Previously Presented) The dispensing apparatus of claim 21, wherein said thermally insulating shield includes a flat panel contacting said air piston housing and a plurality of projections extending between said flat panel and said liquid distribution manifold, said flat panel characterized by a first cross-sectional area and each of said projections characterized by a second cross-sectional area that is smaller than said first cross-sectional area for reducing the conduction of heat from said liquid distribution manifold to said flat panel.

28. (Previously Presented) The dispensing apparatus of claim 21, wherein said thermally insulating shield includes a spacer having a sidewall bounding an enclosed space filled with a gas, said sidewall extending between said air piston housing and said liquid distribution manifold.

29. (Previously Presented) The dispensing apparatus of claim 28, wherein said thermally insulating shield includes one or more dividing walls that compartmentalize said enclosed space.

30. (Previously Presented) The dispensing apparatus of claim 28, wherein said sidewall includes a perimeter enclosed between said air piston housing and said heated support structure so that the gas in said enclosed space is substantially stagnant.

31. (Previously Presented) The method of claim 1 wherein selecting the initial air volume of the air cavity and the effective valve flow coefficient of the solenoid valve further comprises:

modeling operation of the liquid dispensing module with a mathematical model represented by a set of equations; and

numerically solving the set of equations to select the initial air volume and the effective valve flow coefficient.

32. (Previously Presented) A method of intermittently dispensing a liquid from a liquid dispensing module having a discharge outlet and a flow-control mechanism movable with a pneumatic actuator during a cycle time, the cycle time defined as a sum of a first duration to move the flow-control mechanism from a closed position to an open position to dispense the liquid from the discharge outlet and a second duration to move the flow-control mechanism from the open position to the closed position to stop dispensing the liquid from the discharge outlet, the method comprising:

A) moving the flow-control mechanism with the pneumatic actuator from the closed position to the open position in a first portion of the cycle time to dispense the liquid from the discharge outlet;

B) moving the flow-control mechanism with the pneumatic actuator from the open position to the closed position in a second portion of the cycle time to stop dispensing the liquid from the discharge outlet, wherein the cycle time is less than or equal to 9 milliseconds; and

C) repeating the steps A and B for a selected number of times.

33. (Previously Presented) The method of claim 32 wherein the cycle time is less than or equal to 5 milliseconds.

34. (Previously Presented) The method of claim 32 wherein the pneumatic actuator is characterized by an effective valve flow coefficient ranging from about 0.1 to about 1.4.

35. (Previously Presented) The method of claim 32 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 2170 mm^3.

36. (Previously Presented) A liquid dispensing module for dispensing a liquid onto a substrate, comprising:

a dispenser body including a liquid inlet, a discharge outlet, a liquid recirculation outlet, and a flow channel capable of directing a flow of the liquid from said liquid inlet to said discharge outlet and said recirculation outlet;

an actuator;

a first valve seat disposed in said flow channel between said recirculation outlet and said liquid inlet;

a second valve seat disposed in said flow channel between said discharge outlet and said liquid inlet; and

a valve stem operatively coupled with said actuator, said valve stem including a first valve plug and a second valve plug, said valve stem being movable by said actuator between a first position in which said first valve plug contacts said first valve seat and said second valve plug is out of contact with said second valve seat to permit the flow of the liquid from said liquid inlet

to said discharge outlet and a second position in which said first valve plug is out of contact with said first valve seat to permit the flow of the liquid from said liquid inlet to said recirculation outlet and said second valve plug contacts said second valve seat.

37. (Previously Presented) The liquid dispensing module of claim 36 wherein said first valve plug is a spherical head and said first valve seat includes an annular sealing surface capable of making a sealing engagement with said spherical head.

38. (Previously Presented) The liquid dispensing module of claim 36 wherein said second valve plug includes a first frustoconical sealing surface and said second valve seat includes a second frustoconical sealing surface capable of making a sealing engagement with said first frustoconical sealing surface.

39. (Previously Presented) The liquid dispensing module of claim 36 wherein said first valve plug is located between said first valve seat and said recirculation outlet.

40. (Previously Presented) The liquid dispensing module of claim 36 wherein said second valve plug is located between said second valve seat and said discharge outlet.

41. (Previously Presented) The liquid dispensing module of claim 13 wherein said first valve plug is located between said first valve seat and said recirculation outlet.

42. (Previously Presented) The liquid dispensing module of claim 13 wherein said second valve plug is located between said second valve seat and said discharge outlet.

43. (Previously Presented) The dispensing apparatus of claim 21 wherein said thermally insulating shield includes a throughbore that reduces an effective cross-sectional area of said thermally insulating shield.

44. (Previously Presented) The dispensing apparatus of claim 43 wherein said throughbore includes a perimeter enclosed between said air piston housing and said liquid distribution manifold such that a gas confined therein is substantially stagnant.

45. (Previously Presented) The method of claim 33 wherein the pneumatic actuator is characterized by an effective valve flow coefficient ranging from about 0.1 to about 1.4.

46. (Previously Presented) The method of claim 45 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 2170 mm^3.

47. (Previously Presented) The method of claim 45 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 1500 mm^3.

48. (Previously Presented) The method of claim 33 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 2170 mm^3.

49. (Previously Presented) The method of claim 33 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 1500 mm^3.

50. (Previously Presented) The method of claim 34 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 2170 mm^3.

51. (Previously Presented) The method of claim 34 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 1500 mm^3.

52. (Previously Presented) The method of claim 32 wherein the pneumatic actuator includes an air piston housing containing an air cavity and an air piston located in the air cavity, the air cavity being characterized by an initial air volume used to actuate the flow-control mechanism that is less than about 1500 mm^3.

53. (Previously Presented) The method of claim 2 wherein the initial air volume is less than about 2170 mm^3.

54. (Previously Presented) The method of claim 2 wherein the initial air volume is less than about 1500 mm^3.

55. (Previously Presented) The method of claim 2 wherein the effective valve flow coefficient is between about 0.1 to about 1.4.

56. (Previously Presented) The method of claim 55 wherein the initial air volume is less than about 2170 mm^3.

57. (Previously Presented) The method of claim 55 wherein the initial air volume is less than about 1500 mm^3.

58. (Previously Presented) The method of claim 4 wherein the initial air volume is less than about 2170 mm^3.

59. (Previously Presented) The method of claim 4 wherein the initial air volume is less than about 1500 mm^3.

60. (New) The method of claim 2 wherein selecting the initial air volume of the air cavity and the effective valve flow coefficient of the solenoid valve further comprises:

modeling operation of the liquid dispensing module with a mathematical model represented by a set of equations; and

numerically solving the set of equations to select the initial air volume and the effective valve flow coefficient.